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Sir:

Transmitted herewith for filing under 37 CFR 1.53(b) is a(n): ☒ Utility () Design☒ original patent application,

() continuation-in-part application

INVENTOR(S): Rogelio Robles

TITLE: Distributed Printing System And Method

Enclosed are:

☒ The Declaration and Power of Attorney. ☒ signed () unsigned or partially signed☒ 4 sheets of drawings (one set) () Associate Power of Attorney☒ Form PTO-1449 () Information Disclosure Statement and Form PTO-1449

() Priority document(s) () Other (fee \$)

CLAIMS AS FILED BY OTHER THAN A SMALL ENTITY				
(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) TOTALS
TOTAL CLAIMS	32 — 20	12	X \$18	\$ 216
INDEPENDENT CLAIMS	4 — 3	1	X \$78	\$ 78
ANY MULTIPLE DEPENDENT CLAIMS	0		\$260	\$ 0
BASIC FEE: Design \$310.00 () Utility \$690.00				\$ 690
TOTAL FILING FEE				\$ 984
OTHER FEES				\$
TOTAL CHARGES TO DEPOSIT ACCOUNT				\$ 984

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By Terri Walker
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Respectfully submitted,

Rogelio Robles

By Matthew L. Wade

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**PATENT APPLICATION
DOCKET NO. 10001305-1**

DISTRIBUTED PRINTING SYSTEM AND METHOD

INVENTOR:

Rogelio Robles

DISTRIBUTED PRINTING SYSTEM AND METHOD

The Field of the Invention

5 The present invention relates generally to a printing system and, more particularly, to a system for distributing a print job among a number of printers.

Background of the Invention

10 With a conventional printing system, a single print job is typically processed by a single printer. Therefore, processing and printing time for the printing system is limited by the single printer. In addition, printing ability of the printing system is also limited by the single printer. The single printer, for example, may not accommodate all of the printing requirements such as text, graphics, color, etc. which may be required by the single print job.

15 To increase printing time and printing ability, therefore, printing systems have been developed which include multiple printers. Thus, a single print job may be distributed among multiple printers. If the print job is distributed among multiple printers, however, portions of the print job may be completed before others. As such, printers which have finished printing remain idle while the print

20 job is being completed. Thus, idle printers are underutilized and overall processing time for the print job is hindered. In addition, subsequent processing of the print job is delayed. Collation of the print job, for example, cannot be performed until all portions of the print job are completed.

25 Accordingly, a need exists for a printing system which distributes a single print job among a plurality of printers, such that the printers complete the print job at substantially one time.

Summary of the Invention

30 One aspect of the present invention provides a system for printing a print job. The system includes a plurality of printers and a print job distribution system which assess characteristics of the print job and distributes the print job

among a number of printers of the plurality of printers based on the characteristics of the print job such that the number of printers complete the print job at substantially one time.

In one embodiment, the print job distribution system includes a print job
5 assessment system which assesses the characteristics of the print job, a printer ability assessment system which assesses a printing ability of the plurality of printers to print the print job, and a print job allocation system which allocates the print job among the number of printers based on the characteristics of the print job and the printing ability of the plurality of printers. In one embodiment,
10 the print job allocation system divides the print job into a number of print job portions each having a print job weight and allocates the number of print job portions among the number of printers such that all the print job portions are finished at substantially the same time.

In one embodiment, the number of print job portions includes a number
15 of sequential print job portions. In one embodiment, the print job weight of each of the number of print job portions is equal. In one embodiment, the print job weight of each of the number of print job portions is not equal.

In one embodiment, the printing ability of each of the plurality of printers
is equal. In one embodiment, the printing ability of each of the plurality of
20 printers is not equal.

In one embodiment, the characteristics of the print job include at least one of a file size of the print job, a format of the print job, a layout of the print job, and a content of the print job.

In one embodiment, the characteristics of the print job include at least
25 one of a paper size and margins for the print job, a number of lines of text in the print job, a number of words in the print job, a number of characters in the print job, a font size and type of the print job, and an image size in the print job.

In one embodiment, the print job allocation system minimizes a time
required for printing the print job. In one embodiment, the print job distribution
30 system monitors a status of the print job and a performance of the plurality of printers.

Another aspect of the present invention provides a method of printing a print job. The method includes the steps of providing a plurality of printers, assessing characteristics of the print job, and distributing the print job among a number of printers of the plurality of printers based on the characteristics of the print job such that the number of printers complete the print job at substantially one time.

Another aspect of the present invention provides a system for producing a book on-demand. The system includes a processing system adapted to receive and process a book request for the book, a book block preparation system which prepares a book block of the book in response to a book body preparation command of the processing system, a book cover preparation system which prepares a book cover of the book in response to a book cover preparation command of the processing system, and a book finishing system which assembles the book block and the book cover to form the book. In one embodiment, the book block preparation system prints the book block as a print job. As such, the book block preparation system includes a plurality of printers and a print job distribution system which distributes the print job among a number of printers of the plurality of printers, wherein the number of printers complete the print job at substantially one time.

Another aspect of the present invention provides a method of producing a book on-demand. The method includes the steps of receiving and processing a book request for the book, preparing a book block of the book in response to a book body preparation command of the processing system, preparing a book cover of the book in response to a book cover preparation command of the processing system, and assembling the book block and the book cover to form the book. In one embodiment, the step of preparing the book block includes printing the book block as a print job. As such, the step of preparing the book block includes providing a plurality of printers and distributing the print job among a number of printers of the plurality of printers, wherein the number of printers complete the print job at substantially one time.

The present invention provides a printing system which distributes a print job among a plurality of printers such that the printers complete the print job at substantially one time. As such, the printing system minimizes an idle time for the printers, and therefore, maximizes utilization of the printers.

5

Brief Description of the Drawings

Figure 1 is a block diagram illustrating a portion of a distributed printing system according to the present invention;

10 Figure 2 is a block diagram illustrating one exemplary embodiment of a print job distribution system of the system of Figure 1;

Figure 3 is a flow diagram illustrating one exemplary embodiment of a method of distributing a print job according to the present invention; and

15 Figure 4 is a block diagram illustrating one exemplary embodiment of a books-on-demand system including a distributed printing system according to the present invention.

Description of the Preferred Embodiments

In the following detailed description of the preferred embodiments, reference is made to the accompanying drawings which form a part hereof, and in which is shown by way of illustration specific embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural or logical changes may be made without departing from the scope of the present invention. The following detailed description, therefore, is not to be taken in a limiting sense, and the scope of the present invention is defined by the appended claims.

A distributed printing system according to the present invention is illustrated generally at 10 in Figure 1. Distributed printing system 10 provides a system for distributing a print job among a number of printers such that the printers complete the print job at substantially one time. Distributed printing system 10 as well as other embodiments of the distributed printing system according to the present invention include several main components, one or

more of which may include hardware and/or software. The software components of distributed printing system 10 according to the present invention system run on one or more computer and/or server systems capable of performing logical operations. Programming languages suitable for use with the present invention will become apparent to those skilled in the art after reading the present application.

In one exemplary embodiment, as illustrated in Figure 1, distributed printing system 10 includes a print job distribution system 20 and a plurality of printers 30 which print a print job 12. Print job 12 is created, for example, by one or more computer and/or server systems which communicate with print job distribution system 20. Thus, print job distribution system 20 includes hardware and/or software which performs logical operations on print job 12. As such, print job distribution system 20 receives print job 12 and controls printing of print job 12 by printers 30. More specifically, print job distribution system 20 distributes print job 12 among a number of the printers 30.

Print job distribution system 20 measures a weight or print demand of print job 12, as described below, and distributes print job 12 among a number of the printers 30, as represented by arrow 22. Printers 30 include any number of printing devices each communicating with print job distribution system 20 in a parallel manner. In addition, printers 30 may include printing devices having varying capabilities including printing speed, printing resolution, black-and-white and/or color printing, etc. Printers 30 communicate with print job distribution system 20, as represented by arrow 32. As such, print job distribution system 20 receives operational data from printers 30. Accordingly, print job distribution system 20 monitors a status of print job 12 when being printed by printers 30 and provides feedback of an ability and/or performance of printers 30 in printing print job 12.

In one exemplary embodiment, as illustrated in Figure 2, print job distribution system 20 includes a print job assessment system 24, a printer ability assessment system 26, and a print job allocation system 28. Print job assessment system 24 assesses the weight of print job 12, printer ability assessment system

26 assesses an ability of printers 30 to print print job 12, and print job allocation system 28 allocates print job 12 among printers 30. Print job assessment system 24 and printer ability assessment system 26 both communicate with print job allocation system 28. As such, print job allocation system 28 divides print job 12 among a number of the printers 30 based on print job assessment system 24 and printer ability assessment system 26.

To assess the weight of print job 12, print job assessment system 24 assesses print characteristics of print job 12. Print characteristics of print job 12 include, for example, a file size of print job 12, a format of print job 12, a layout of print job 12, and/or a content of print job 12. The format of print job 12 includes, for example, a file type of print job 12. The layout of print job 12 includes, for example, a paper size and margins for print job 12. The content of print job 12 includes, for example, text, graphics, images, tables, etc. in print job 12. Thus, the content of print job 12 includes, for example, a number of lines of text in print job 12, a number of words in print job 12, a number of characters in print job 12, a font type and size of print job 12, and/or whether print job 12 is in black-and-white or color. By analyzing print characteristics of print job 12, therefore, print job assessment system 24 can establish the weight of print job 12.

To assess a printing ability of printers 30, printer ability assessment system 26 considers printing capabilities of printers 30. Printing capabilities of printers 30 include, for example, a number of pages printed per minute for each of the printers 30, black-and-white or color printing capabilities of printers 30, and/or printing resolution of printers 30. It is within the scope of the present invention for printing capabilities of printers 30 to be equal and/or unequal. For example, one of the printers 30 may be a black-and-white printer which is not capable of printing color or one of the printers 30 may be a high-speed printer which is capable of printing more pages per minute than one or more other printers 30. Thus, distributed printing system 10 can accommodate a variety of print characteristics such as format, layout, and/or content of print job 12.

Print job allocation system 28 divides print job 12 into a number of print job portions based on the weight of print job 12 and the printing abilities of printers 30. Each of the print job portions have a print job weight such that a sum of the print job portions is equal to print job 12. In dividing print job 12 into the number of print job portions, print job allocation system 28 considers processing and printing times of print job 12 and printers 30. Thus, print job allocation system 28 allocates the print job portions among a number of the printers 30 such that all of the print job portions are finished at substantially the same time.

The number of printers 30 among which print job 12 is allocated includes any number of the printers 30. For example, print job allocation system 28 may allocate print job 12 among only one of the printers 30, all of the printers 30, or any number of printers 30 therebetween. It is within the scope of the present invention for the print job weight of each of the print job portions to be equal and/or unequal. For example, the print job weight of one of the print job portions may be greater than the print job weight of one or more other print job portions. Based on the printing capabilities of printers 30, however, all of the print job portions are completed at substantially the same time.

In Figure 3, a flow diagram illustrating one exemplary embodiment of a method of printing print job 12 according to the present invention is illustrated generally at 100. Reference is also made to Figures 1 and 2. At step 110, print job 12 is generated, for example, by a computer system. As such, at step 120, print job 12 is received and processed, for example, by print job distribution system 20. Accordingly, in step 130, the weight of print job 12 is assessed, for example, by print job assessment system 24. In addition, in step 140, an ability of printers 30 to print print job 12 is assessed, for example, by printer ability assessment system 26. Thereafter, in step 150, print job 12 is allocated among a number of the printers 30, for example, by print job allocation system 28. Thus, in step 160, print job 12 is printed such that the number of the printers 30 complete print job 12 at substantially one time.

By distributing a print job among a plurality of printers such that the printers complete the print job at substantially one time, distributed printing system minimizes an idle time for the printers and, therefore, maximizes utilization of the printers.

5 In one illustrative embodiment, distributed printing system 10 is included in a books-on-demand system illustrated generally at 200 in Figure 4. Books-on-demand system 200 receives orders for single and/or multiple copies of a book and produces the book on-demand. More specifically, books-on-demand system 200 retrieves an electronic file of the book and then prints and binds a
10 copy of the book.

In one exemplary embodiment, books-on-demand system 200 includes a processing system 210, a book block preparation system 220, a book cover preparation system 230, and a book finishing system 240. In one exemplary embodiment, processing system 210 includes hardware and software for
15 receiving and processing a book request. Processing system 210 retrieves an electronic file of a book being requested and produces a print command for a body of the book and a print command for a cover of the book.

In response to the print commands, book block preparation system 220 and book cover preparation system 230 prepare a book block and a book cover,
20 respectively. Thereafter, book finishing system 240 assembles the book block and the book cover to form a finished book. The book cover includes a sheet or piece of material cut to a desired size and is formed from a suitable sheet material such as paper, cardboard, and/or plastic film. The book cover can also include a cover image in the form of characters and/or graphics as is well known
25 in the art. The book block includes a plurality of sheets of paper which form a body of the book. The body of the book includes, for example, a table of contents, text, index, etc.

In one exemplary embodiment, book block preparation system 220 includes a printing system 222, a collator 224, and a jogger 226. To facilitate
30 printing of the book block as a print job, printing system 222 includes distributed printing system 10. Printing system 222, therefore, includes print job

distribution system 20 and the plurality of printers 30. As such, print job distribution system 20 measures a weight or print demand of the book block and distributes the print job for the book block among a number of the printers 30. As such, printing system 222 prints the body of the book in a number of print job portions on several sheets of paper such that all of the print job portions are finished at substantially the same time. Thereafter, collator 224 collates the print job portions and the sheets of paper and jogger 226 vibrates or shakes the sheets to align the edges of the paper in forming the book block.

In one exemplary embodiment, book cover preparation system 230 includes a printing system 232, a laminator 234, and a scorer/cutter 236. Printing system 232 includes a color printer which prints the book cover. Laminator 234 laminates the book cover and scorer/cutter 236 scores the book cover with crease lines which facilitate bending of the book cover along a spine of the book block.

In one exemplary embodiment, book finishing system 240 includes a book binder 242 and a book trimmer 244. As such, the book cover is registered in book binder 242 and the book block is positioned on the book cover. Then, the book block is bound with the book cover by book binder 242 as is well known in the art. Thereafter, book trimmer 244 trims the book cover if necessary. Thus, the finished book is produced.

By allocating the print job portions among a number of the printers 30 such that all of the print job portions are finished at substantially the same time, distributed printing system 10 minimizes an idle time for printers 30 and, therefore, maximizes utilization of printers 30. In addition, by distributing the print job for the book block among a number of the printers 30, distributed printing system 10 increases throughput of printing system 222 and, therefore, book block preparation system 220. Thus, book block preparation system 220 prepares the book block while book cover preparation system 230 prepares the book cover. Book finishing system 240, therefore, can immediately assemble the book block and the book cover to form the finished book.

Although specific embodiments have been illustrated and described herein for purposes of description of the preferred embodiment, it will be appreciated by those of ordinary skill in the art that a wide variety of alternate and/or equivalent implementations calculated to achieve the same purposes may be substituted for the specific embodiments shown and described without departing from the scope of the present invention. Those with skill in the chemical, mechanical, electro-mechanical, electrical, and computer arts will readily appreciate that the present invention may be implemented in a very wide variety of embodiments. This application is intended to cover any adaptations or variations of the preferred embodiments discussed herein. Therefore, it is manifestly intended that this invention be limited only by the claims and the equivalents thereof.

WHAT IS CLAIMED IS:

1. A system for printing a print job, the system comprising:
a plurality of printers; and
a print job distribution system which assesses characteristics of the print job and distributes the print job among a number of printers of the plurality of printers based on the characteristics of the print job such that the number of printers complete the print job at substantially one time.
2. The system of claim 1, wherein the print job distribution system includes a print job assessment system which assesses the characteristics of the print job, a printer ability assessment system which assesses a printing ability of the plurality of printers to print the print job, and a print job allocation system which allocates the print job among the number of printers based on the characteristics of the print job and the printing ability of the plurality of printers.
3. The system of claim 2, wherein the print job allocation system divides the print job into a number of print job portions each having a print job weight and allocates the number of print job portions among the number of printers such that all the print job portions are finished at substantially the same time.
4. The system of claim 3, wherein the number of print job portions includes a number of sequential print job portions.
5. The system of claim 3, wherein the print job weight of each of the number of print job portions is equal.
6. The system of claim 3, wherein the print job weight of each of the number of print job portions is not equal.

7. The system of claim 2, wherein the printing ability of each of the plurality of printers is equal.
8. The system of claim 2, wherein the printing ability of each of the plurality of printers is not equal.
9. The system of claim 2, wherein the print job allocation system minimizes a time required for printing the print job.
10. The system of claim 1, wherein the characteristics of the print job include at least one of a file size of the print job, a format of the print job, a layout of the print job, and a content of the print job.
11. The system of claim 1, wherein the characteristics of the print job include at least one of a paper size and margins for the print job, a number of lines of text in the print job, a number of words in the print job, a number of characters in the print job, a font size and type of the print job, and an image size in the print job.
12. The system of claim 1, wherein the print job distribution system monitors a status of the print job and a performance of the plurality of printers.
13. A method of printing a print job, the method comprising the steps of:
providing a plurality of printers;
assessing characteristics of the print job; and
distributing the print job among a number of printers of the plurality of printers based on the characteristics of the print job such that the number of printers complete the print job at substantially one time.
14. The method of claim 13, wherein the step of distributing the print job includes assessing a printing ability of the plurality of printers to print the print

job and allocating the print job among the number of printers based on the characteristics of the print job and the printing ability of the plurality of printers.

15. The method of claim 14, wherein the step of distributing the print job includes dividing the print job into a number of print job portions each having a print job weight and allocating the number of print job portions among the number of printers such that all of the print job portions are finished at substantially the same time.
16. The method of claim 15, wherein the number of print job portions includes a number of sequential print job portions.
17. The method of claim 15, wherein the print job weight of each of the number of print job portions is equal.
18. The method of claim 15, wherein the print job weight of each of the number of print job portions is not equal.
19. The method of claim 14, wherein the printing ability of each of the plurality of printers is equal.
20. The method of claim 14, wherein the printing ability of each of the plurality of printers is not equal.
21. The method of claim 14, wherein the step of distributing the print job includes minimizing a time required for printing the print job.
22. The method of claim 13, wherein the step of assessing the characteristics of the print job includes assessing at least one of a file size of the print job, a format of the print job, a layout of the print job, and a content of the print job.

23. The method of claim 13, wherein the step of assessing the characteristics of the print job includes assessing at least one of a paper size and margins for the print job, a number of lines of text in the print job, a number of words in the print job, a number of characters in the print job, a font size and type of the print job, and an image size in the print job.

24. The method of claim 13, wherein the step of distributing the print job includes monitoring a status of the print job and a performance of the plurality of printers.

25. A system for producing a book on-demand, the system comprising:
a processing system adapted to receive and process a book request for the book, the processing system adapted to retrieve a data file which includes contents of the book and produce a book body preparation command and a book cover preparation command from the data file;

a book block preparation system which prepares a book block of the book in response to the book body preparation command;

a book cover preparation system which prepares a book cover of the book in response to the book cover preparation command; and

a book finishing system which assembles the book block and the book cover to form the book,

wherein the book block preparation system prints the book block as a print job, and wherein the book block preparation system includes a plurality of printers and a print job distribution system which distributes the print job among a number of printers of the plurality of printers, wherein the number of printers complete the print job at substantially one time.

26. The system of claim 25, wherein the print job distribution system includes a print job assessment system which assesses a weight of the print job, a printer ability assessment system which assesses a printing ability of the plurality of printers to print the print job, and a print job allocation system which

allocates the print job among the number of printers based on the weight of the print job and the printing ability of the plurality of printers.

27. The system of claim 26, wherein the print job allocation system divides the print job into a number of print job portions each having a print job weight and allocates the number of print job portions among the number of printers, wherein all the print job portions are finished at substantially the same time.

28. The system of claim 27, wherein the number of print job portions includes a number of sequential print job portions.

29. A method of producing a book on-demand, the method comprising the steps of:
- receiving and processing a book request for the book including retrieving a data file which includes contents of the book and producing a book body preparation command and a book cover preparation command from the data file;
 - preparing a book block of the book in response to the book body preparation command;
 - preparing a book cover of the book in response to the book cover preparation command; and
 - assembling the book block and the book cover to form the book, wherein the step of preparing the book block includes printing the book block as a print job, and wherein the step of preparing the book block includes providing a plurality of printers and distributing the print job among a number of printers of the plurality of printers, wherein the number of printers complete the print job at substantially one time.

30. The method of claim 28, wherein the step of distributing the print job includes assessing a weight of the print job, assessing a printing ability of the plurality of printers to print the print job, and allocating the print job among the

number of printers based on the weight of the print job and the printing ability of the plurality of printers.

31. The method of claim 30, wherein the step of distributing the print job
5 includes dividing the print job into a number of print job portions each having a print job weight and allocating the number of print job portions among the number of printers, wherein all of the print job portions are finished at substantially the same time.
- 10 32. The method of claim 31, wherein the number of print job portions includes a number of sequential print job portions.

DISTRIBUTED PRINTING SYSTEM AND METHOD

Abstract of the Disclosure

- 5 A system for printing a print job includes a plurality of printers and a print job distribution system which distributes the print job among a number of printers of the plurality of printers. The print job distribution system distributes the print job such that the number of printers complete the print job at substantially one time.

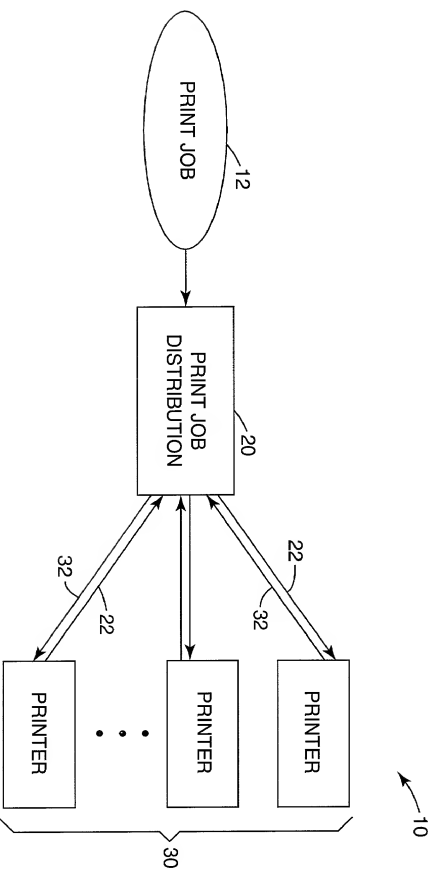


Fig. 1

09643700:074100

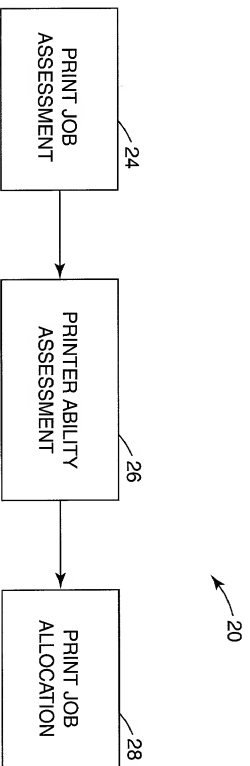


Fig. 2

09613700-071100

FIG. 3

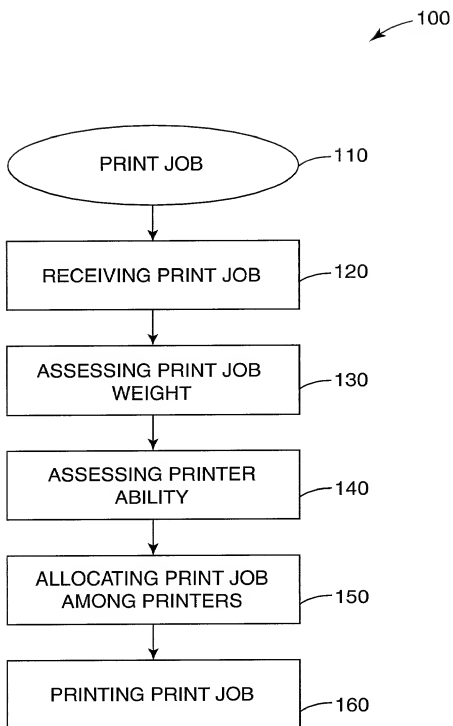


Fig. 3

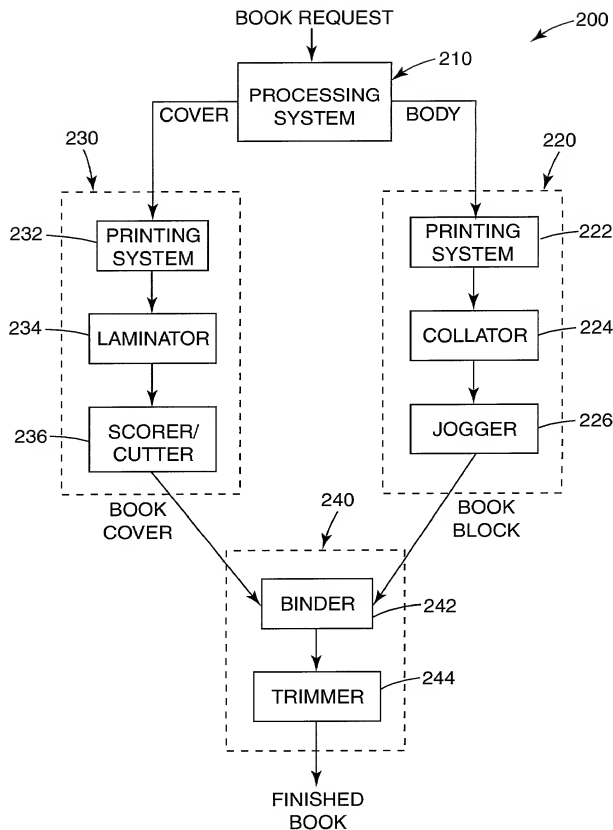


Fig. 4

DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATIONATTORNEY DOCKET NO. 10001305-1

As a below named inventor, I hereby declare that:

My residence/post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Distributed Printing System and Method

the specification of which is attached hereto unless the following box is checked:

() was filed on _____ as US Application Serial No. or PCT International Application
Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56.

Foreign Application(s) and/or Claim of Foreign Priority

I hereby claim foreign priority benefits under Title 35, United States Code Section 119 of any foreign application(s) for patent or inventor(s) certificate listed below and have also identified below any foreign application for patent or inventor(s) certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE FILED	PRIORITY CLAIMED UNDER 35 U.S.C. 119
			YES: _____ NO: _____
			YES: _____ NO: _____

Provisional Application

I hereby claim the benefit under Title 35, United States Code Section 119(e) of any United States provisional application(s) listed below:

APPLICATION SERIAL NUMBER	FILING DATE

U. S. Priority Claim

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (patented/pending/abandoned)

POWER OF ATTORNEY:

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

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Fort Collins, Colorado 80528-9599**Direct Telephone Calls To:**Matthew L. Wade
(208) 396-5263

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Inventor: Rogelio RoblesCitizenship: MexicoResidence: La Ley 2960-9, Res. Juan Manuel, Guadalajara, Jalisco 44680 MexicoPost Office Address: Same as ResidenceInventor's Signature Rogelio A. RoblesDate 07/04/00